



## US LHC Accelerator Research Program *brookhaven - fermilab - berkeley*

### Hardware Commissioning

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For the BNL-FNAL-LBNL LHC Accelerator Collaboration

DOE Review

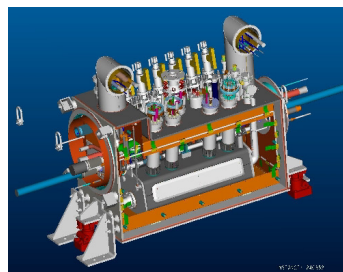
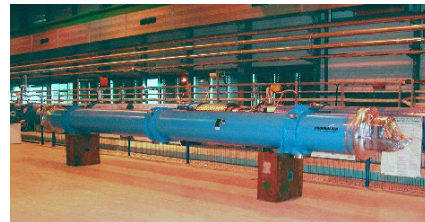
10 June 2003



### US-Provided Accelerator Equipment

Insertion Region Systems: Points 1, 2, 4, 5, 8

- US-built quadrupoles (FNAL)
- Japanese-built quadrupoles (KEK)
- CERN-provided correctors
- Cryostats for all quadrupole assemblies (FNAL)
- US-built beam separation dipoles (BNL)
- US-built IR feed boxes (LBNL)
- US-built specialized absorbers (LBNL)



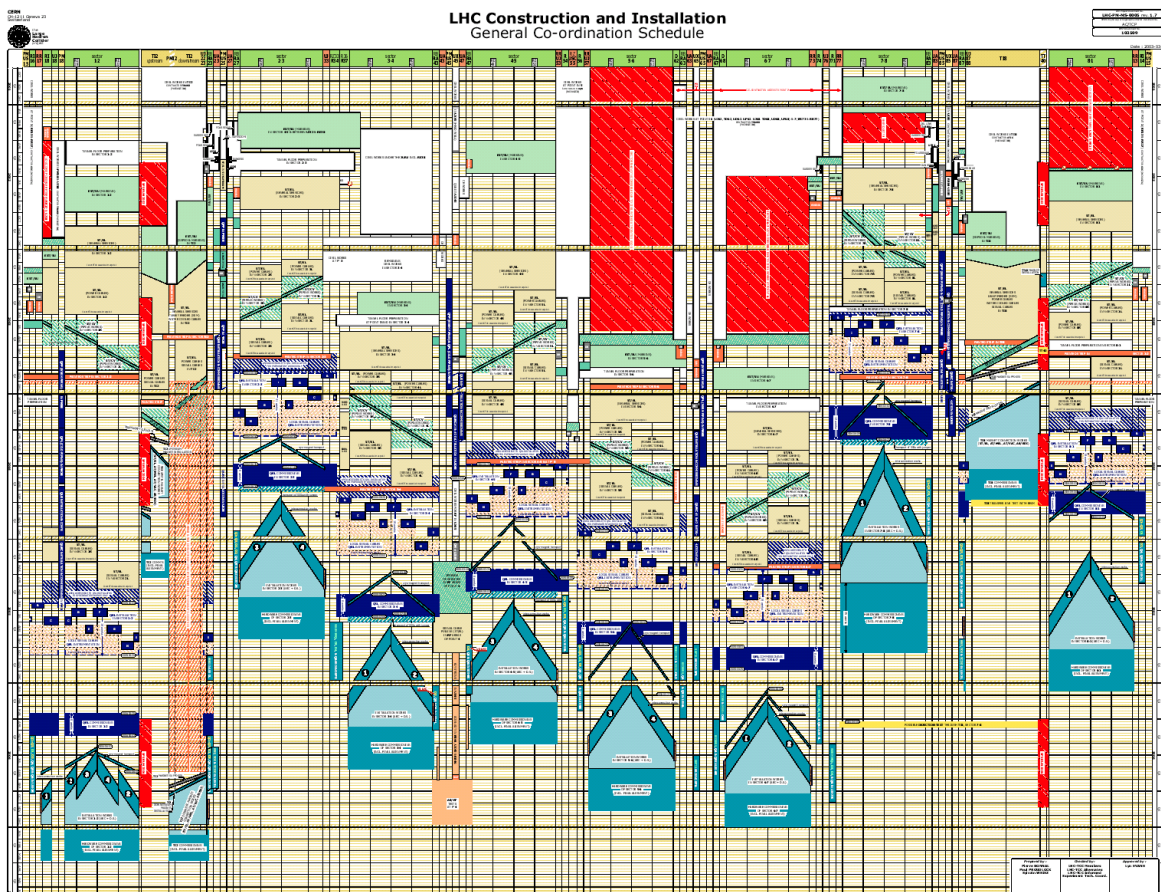


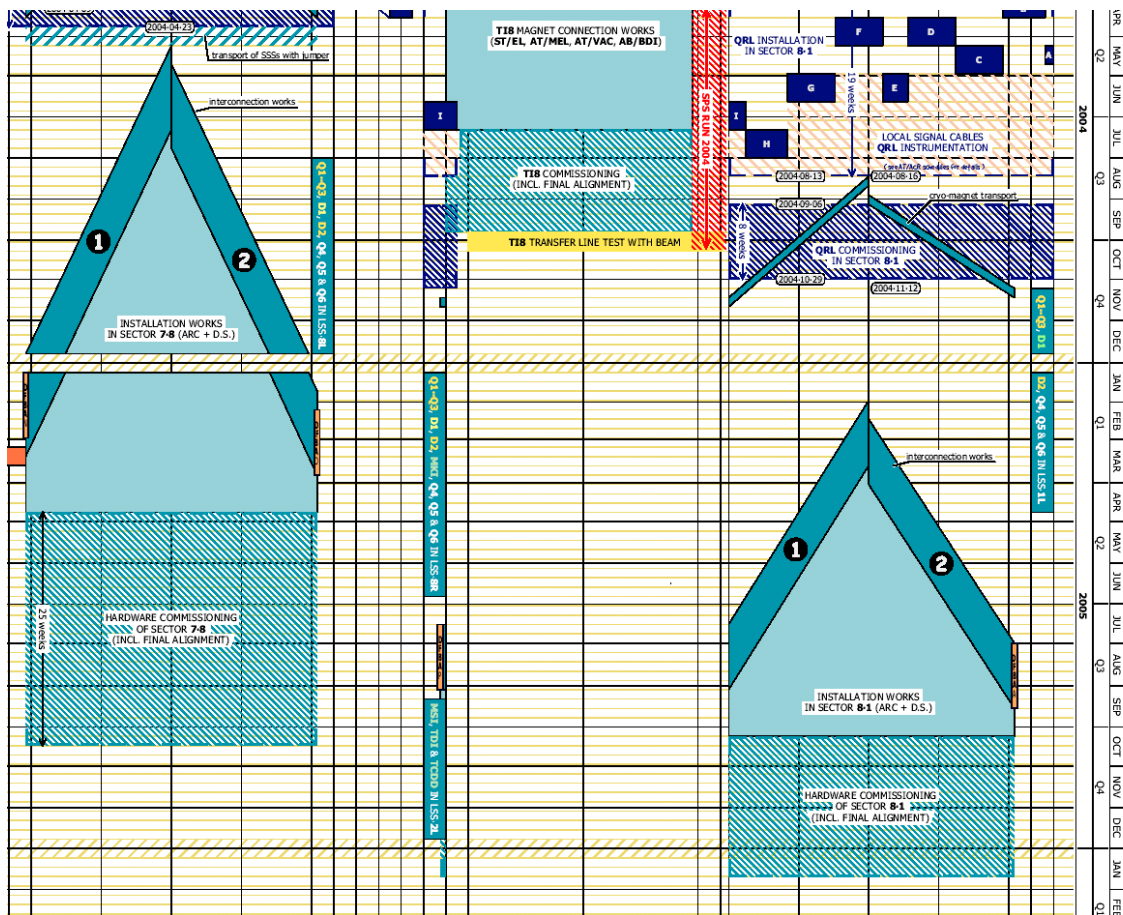
## Commissioning of US-Provided Hardware

The US LHC Accelerator (construction) Project did not anticipate nor include resources for involvement in commissioning of our equipment.

However, we need to be involved in the commissioning of our systems.

- It will speed the turn-on of the machine for HEP.
- We will get direct feed-back on the performance of our designs.
  - The first system test of the inner triplets (and the first cold-test of the feedboxes) will be in the tunnel.
  - The behavior with the large beam-induced heat load is important to understand, especially as we look towards 2<sup>nd</sup> generation IRs for a luminosity upgrade.
- The U.S. DOE Labs need to stand behind their products.
  - Problems that arise during commissioning can best be solved with the participation of the experts who designed the equipment.





## Hardware Commissioning Schedule

FY	Installation	Commissioning	Beam	Activity
2004	IR 8L			Planning
2005	IR 1L, 2R, 4R, 5L, 5R, 8R	IR2R, 8L		Hdw. Commissioning without beam.
2006	IR 1R, 2L, 4L	IR 1L, 4L, 4R, 5L, 5R, 8R	Injection Test (IR 8L and 8R)	Hdw. Commissioning + injection test.
2007		IR 1R, 2L	First Beam	System performance with Lum.
2008			$L > 10^{33}$	

- Modest effort by U.S. experts (~2 FTEs) will ensure that our equipment is integrated efficiently and that we learn about system performance.
- This will include a small on-site contingent to provide continuity and oversight, overlapping with shorter term assignments.
- A modest M&S budget will be provided to allow hardware issues uncovered during commissioning to be addressed.



## Summary

- It is in our interest to participate in hardware commissioning of the U.S.-provided equipment and systems.
  - Help speed the machine start-up.
  - Direct feed-back on the performance of our designs.
    - Important for design of LHC upgrades and future hadron colliders.
- Planning must start NOW. (First CERN planning meeting on IR8 commissioning has just been held.)
- Work is most intense in FY2005-07.
- Modest effort continues until IR system performance is understood with significant beam heating => ~2008.